Proposed Agreement between California Energy Commission
and
Stone & Webster, Inc.

Title: Assessment of Natural Gas Combined Cycle Plants for Carbon Dioxide Capture and Storage in a Gas-Dominated Electricity Market
Amount: $1,053,200.00
Term: 10 months
Contact: Cheryl Closson
Committee Meeting: 1/6/2011

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	ETSI	WESTCARB	$2,890,747	$1,053,200	$1,837,547	64%

Recommendation

Approve this agreement with Stone & Webster, Inc. for $1,053,200.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

Issue

A substantial portion of California's power supply is now provided by large natural gas combined cycle (NGCC) power plants. Between 1995 and 2009, approximately fifty F- and H-Class gas turbines (GTs) were commissioned in the state. With the highest efficiency among the fossil fuel-fired units serving California, many of these units operate at relatively high capacity factors. Consequently, they are among the state's top annual producers of carbon dioxide (CO2) emissions.

An issue of concern in California energy research is how to best manage emissions of CO2 from natural gas-fired electrical power plants to prevent further increases in atmospheric CO2 levels that may contribute to global climate change. One mechanism for managing CO2 that is currently being evaluated is the capture and geological storage of the CO2 (known as carbon capture and storage or CCS) entrained in power plant flue gases. However, there is currently very little information available on the specific engineering elements and economic considerations associated with incorporating CCS at the NGCC power plants common in California. In addition, there are few research efforts specifically addressing GT exhaust, which has a higher oxygen concentration and lower CO2 concentration than flue gas from coal-fired boilers.

In considering CCS as a means for meeting CO2 emission reduction goals, California's utilities need current information on the near-commercial-ready and emerging options for implementing CCS on NGCC units. This information is crucial for utilities to understand the nature and magnitude of cost and performance impacts associated with CCS operation. In addition, operating flexibility may be affected by CCS regulatory issues and CCS system dynamics. Overall reliability of the generating unit may also be reduced by the added complexity of CO2 capture and compression/dehydration equipment. The scope of this contract is aimed at enhancing the information available to power generation planners and policymakers for use in their decisions and investments associated with CO2 and greenhouse gas (GHG) reductions.

Background

To support development of CCS technologies and evaluate storage options, the United States Department of Energy (DOE) established regional partnerships to characterize regional carbon storage opportunities and to conduct technology validation and large-volume storage tests. The West Coast

Regional Carbon Sequestration Partnership (WESTCARB) is one of the seven research partnerships formed and funded by DOE. WESTCARB represents all or part of seven states - Alaska, Arizona, California, Hawaii, Nevada, Oregon, and Washington - and the Canadian province of British Columbia. The Energy Commission's PIER program manages WESTCARB and also provides match funding for WESTCARB projects.

As the WESTCARB prime contractor, PIER is currently funded under Phase II of the DOE partnership cycle to conduct site and facility assessments for CCS implementation. One WESTCARB project identified for Phase II is an assessment of the technical and economic viability of retrofitting existing California natural gas-fired combined cycle (NGCC) plants or designing new facilities to capture CO2 from plant emissions for transport and storage. WESTCARB allocated $1,400,000 of its federal funding to this project and released a Request for Proposals (RFP #500-10-502) in October 2010 for proposals from contractors to complete the project work.

After competitive evaluation of the proposals received for RFP #500-10-502, Stone & Webster, Inc. was selected as the contract awardee based on technical evaluation, budget, and business preference scores. The total project amount established under the Stone & Webster, Inc. proposal is $1,053,200. PIER is providing funding for the entire project from the allocated WESTCARB federal funds.

Due to the DOE Phase II funding deadline of September 30, 2011, the contract duration for this project is limited to six months. This will allow the contractor to complete all work and reporting as necessary for the DOE funding. Pacific Gas and Electric Company (PG&E) and Lawrence Livermore National Laboratory (LLNL) are Key Partners for this effort, but all contractual arrangements and management authority resides with the Energy Commission. Additional organizations, such as other California investor-owned utilities or NGCC plant owners/operators, may become Key Partners over the course of the project.

Proposed Work

The goals of this agreement are to evaluate the technical design considerations and ability to capture CO2 from NGCC power plants and estimate the costs and performance impacts associated with capture and storage of the plant's CO2 emissions. These goals will be achieved by developing:

1. A basic evaluation of CO2 capture technology options for use at NGCC power plants;
2. An engineering and economic assessment report on the installation and operation of selected CCS technologies, in retrofit and new-build applications, at California utility-scale NGCC power plants; and 3. A preliminary design for a pilot-scale CO2 capture, compression/dehydration, transport, and injection well test facility.

Stone & Webster, Inc. will perform the research and engineering necessary to complete the work using information from their own previous work experience, publicly available documents, and prior research by WESTCARB, PG&E, and LLNL. A Project Advisory Committee (PAC), comprised of representatives from the Energy Commission, PG&E, LLNL, and other interested stakeholders will be utilized to help guide the Contractor's efforts.

For the evaluation of CO2 capture technologies, Stone & Webster, Inc. will characterize the technologies based on their level of development, commercial maturity, and interaction with power plant design and operation. Consistent with the criteria set in the RFP, the technologies considered will be those with reasonable prospects of being commercially available by 2020, and each technology must be at a minimum development threshold of one megawatt scale by March 2011. Stone & Webster, Inc. will also compare the costs and performance impacts of the selected technologies and address any potential regulatory and permitting barriers to implementation.

Stone & Webster, Inc. will develop and apply an engineering options analysis procedure for CO2 capture for both retrofit and new-build scenarios. Criteria to be considered in the analysis include capital costs, required equipment and space for installation, measures of CO2 capture effectiveness and cost, gross and net power output, cooling requirements and options, impact of CO2 capture and compression on startup time and implications for the electricity grid. A sensitivity analysis will also be performed to examine the cost and performance impacts of possible design and operation options.

In the last task, Stone & Webster, Inc. will integrate all the previous analyses and, with guidance from the PAC, will determine the pilot-scale integrated CCS project type and location(s) in PG&E's service area that would best advance a pre-commercial CO2 capture technology toward commercial operation in California. Stone & Webster, Inc. will then conduct a feasibility study for a pilot-scale technology validation test at the proposed site.

The total budget for this project is $1,053,200, with the entire amount coming from PIER's federal WESTCARB funding. In general, the agreement funds will be spent as follows:

- 52% - Direct Labor and Fringe Benefits
- 31% - Indirect Overhead
- 3% - Minor Sub-contractors
- 5% - General and Administrative (G&A)
- 8% - Profit
- 1% - Travel

All project reports will be public documents that will be made available to WESTCARB partners, PG&E and other California utilities, other carbon sequestration partnerships, and any other interested parties. Results and reports will be made available on the internet via the WESTCARB website and also available in hard-copy. Project findings will be presented at the WESTCARB annual meeting and other DOE meetings and conferences.

Justification and Goals

This project "[will] advance energy science or technologies of value to California citizens..." (Public Resources Code 25620.(c)), and is part of a "full range of research, development, and demonstration activities that . . . are not adequately provided for by competitive and regulated markets (Public Resources Code 25620.1.(a)).

This project also addresses the goals of Senate Bill 1368 (Perata, Chapter 598, Statutes of 2006), the Greenhouse Gases Emission Performance Standard for Baseload Electrical Generating Resources. In addition, the project supports development of mechanisms for power plant compliance with AB 32 GHG emissions standards being developed for California facilities.

This will be accomplished by:

Determining what carbon capture technologies are best suited for California NGCC plants.
Assessing the cost effectiveness of CCS technologies for NGCC plants.
Developing a preliminary design for a pilot-scale CO2 capture, compression/dehydration, transport, and injection well test facility.